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HEARING DEGRADATION WHILE WEARING COLD WEATHER HEADGEAR,(U)
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Consulting Report

HEARING DEGRADATION WHILE WEARING COLD WEATHER HEADGEAR

by
James W. Dees, Kevin J. O'Reilly
and David R. Sennett

April 1968

This Consulting Report has been prepared to provide information to the requesting agency on the results of Technical Advisory Service. It does not necessarily represent the official opinion or policy of either the Human Resources Research Office or the Department of the Army.

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REPORT DOCUMENTATION PAGE

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

A limited study was conducted to provide an estimate of the hearing penalty incurred when wearing the Army's cold weather headgear. The expected hearing loss did occur. The hearing loss, as measured by an articulation test, is given for three difference signal to noise rations. More important, however, a disproportionately higher error rate was noted when wearing the cold weather headgear under low signal to noise conditions. That is, the difference between the error rate with the headgear on and with it off is

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much greater with low signal to noise ratios than with high ratios. Furthermore, the obtained disproportionate error rate is due primarily to mistakes on consonants. The deterioration of hearing while wearing the headgear with low signal to noise rations is most pronounced with rapid consonant-lie sounds. The implication is that the soldier wearing the protective gear is much more likely to miss or confuse sounds that are only slightly above the existing background noise level, such as sounds of surreptitious enemy movement or orders spoken softly or at a distance, than is the soldier not wearing it.

PREFACE

This report represents the results of an experiment conducted by HumRRO Division No. 4 (Infantry), Fort Benning, Georgia at the request of the Chief, Office of Infantry Doctrine and Materiel, U. S. Army Infantry School. The authors wish to express their appreciation to Captain Kenneth D. Tracy, Medical Service Corps, Preventive Medicine for making the sound level measures.

The report was prepared as Technical Advisory Service under the provisions of Army Contract DA 44-188-ARO-2 and Army Project 2J024701A712 01.

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SUMMARY AND CONCLUSIONS

A limited study was conducted to provide an estimate of the hearing penalty incurred when wearing the Army's cold weather headgear. The expected hearing loss did occur. The hearing loss, as measured by an articulation test, is given for three different signal to noise ratios. More important, however, a disproportionately higher error rate was noted when wearing the cold weather headgear under low signal to noise conditions. That is, the difference between the error rate with the headgear on and with it off is much greater with low signal to noise ratios than with high ratios. Furthermore, the obtained disproportionate error rate is due primarily to mistakes on consonants. The deterioration of hearing while wearing the headgear with low signal to noise ratios is most pronounced with rapid consonant-like sounds. The implication is that the soldier wearing the protective gear is much more likely to miss or confuse sounds that are only slightly above the existing background noise level, such as sounds of surreptitious enemy movement or orders spoken softly or at a distance, than is the soldier not wearing it.

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INTRODUCTION

On 4 April 1968 HumRRO Division No. 4 (Infantry) received a request from the Chief, Office of Infantry Doctrine and Materiel, USAIS, to provide information concerning the hearing degradation resulting from wearing the Army's cold weather headgear. The items are (1) cap, insulating helmet liner DSA-100-67-6-C-4098 and FSN 8415-782-2919, (2) parka-liner, pile M-48, and (3) parka-shell, cotton, O.D. M-48 Stock No. 55-p-4980-30.

The object of the effort was to provide information which would assist in the judgments concerning the need for improving the hearing capability of the soldier when wearing the cold weather headgear. While some relevant work was previously done in this area at the U. S. Army Arctic Test Board,[1] hearing degradation was only a side issue in the Board's tests. The tests, however, did confirm the existence of a hearing problem.

It therefore was decided to conduct a limited experiment in order to provide information which would allow an assessment of the magnitude of the problem. The experiment does not cover all pertinent variables, and does not provide an estimate of the hearing degradation under all conditions. For example, the subjects were never moving during the test. (Movement would probably have resulted in a greater hearing decrement than was actually found in the no-movement condition.) Also only the "cap with flaps down, parka with neck snaps fastened" condition was examined. Other combinations of the cap and/or the parka hood were not examined. However, the test does furnish information concerning the amount of hearing loss in this one set of conditions.

METHOD

SITUATION

The situation chosen for examination was the accuracy of the perception of monosyllabic words under three loudness levels with the headgear on and off. Background noise was the ambient noise level of the environment, which remained fairly constant.

APPARATUS

Two tape recorders were used in the study. The monosyllabic test words were played from one. The subjects' interpretation of those words was recorded on the other. A sound level meter was used to establish the

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[1] U.S. Army Infantry Board Project NR2969 Service Test of Cap, Cold Weather, T61-4 (U).

background noise level, the signal loudness, and the attenuation of the headgear. The sound level meter was of the integrating variety rather than an impulse model. However, speech is composed of sudden and rapid signals. Therefore, the loudness readings for the monosyllabic words are not as accurate as could have been obtained with an impulse model sound level meter. Nevertheless, it is judged that the readings are accurate enough for the intended purpose. The sound level meter was calibrated in decibels from a reference of 0.0002 dyne per square centimeter pressure.

The room in which the experiment was conducted was equipped with acoustical tile, but the windows were open and the subject was exposed to variable levels of street noise. However, the street and the general area around the research building are quiet. An air conditioner across the street was run during the entire experiment. This was included in the measurement of the ambient noise level of the room and served to mask small noises in the neighborhood.

The first word recorded was used as an index. Three tape recorder settings were calibrated to produce 70, 80 and 90 db with reference to 0.0002 dyne/cm^2 respectively on the word "jib" as measured from the subjects' position 10 feet from the two speakers. "Jib" was the first word of the first group. The score sheets are furnished in Appendix A. In the first column, the decibel ratings for each word are given for the 70 db setting for the word "jib." Table 1 furnishes some everyday references for the decibel scale.

Table 1

REFERENCES FOR THE DECIBEL SCALE[a]

Decibels	Common Sounds
140	Jet fighter aircraft with afterburner at 20 feet
120	DC7 at 20 feet
100	Subway at 20 feet or boiler shop
80	Passing truck at 20 feet or pneumatic drill
60	Conversation at five feet
40	Quiet residence or office
25	Broadcast studio
0	Threshold for audibility of a pure 1,000 cps tone

[a]From Morgan, C.T., Cook J.S., Chapanis, A., and Lund, M.W. Human Engineering Guide to Equipment Design, McGraw Hill Book Company, New York, 1963, p. 139; and Woodworth, R.S. and Schlosberg, H. Experimental Psychology (Revised Edition), Henry Holt and Company, New York, 1960, p. 325.

SUBJECTS

Twelve subjects were used. They were the entire Psychological Specialist population of the Human Research Unit at Fort Benning (excluding two who functioned as experimenters) plus two officers and one NCO who were also members of the Unit.

PROCEDURE

Subjects were read a set of instructions (Appendix B) and were requested to sit in a chair with its back to a set of speakers located 10 feet away. They then listened to six groups of 50 monosyllabic words played from a tape recorder over the speakers and recorded their interpretation of the words over a second tape recorder. Each word consisted of an initial consonant sound followed by a vowel sound followed by a final consonant sound. The 50 words in each group were recorded at five-second intervals (beginning to beginning) with 30 seconds between groups. The six groups were always played in the same order. The loudness of the signal and the presence or absence of headgear were varied in a counterbalanced design according to Table 2. Each subject was exposed to all six combinations of loudness level and presence or absence of headgear. The purpose of counterbalancing was to equate the effects of order of occurrence in the test across all conditions of the test.

One experimenter managed the signal tape recorder while a second experimenter sat behind a screen, which blocked his view from the subject, and recorded the subject's responses on a score sheet. The tape recordings of the subject's responses were used as a check.

RESULTS

CALIBRATION

The background noise level was measured as 52 db re 0.0002 dyne/cm^2. The sound decrement was measured by placing the sensor head inside the garment with the material between the standard sound source and the sensor head. The attenuation compared to the open air condition was 10 db for a 400 cps tone and 12 db for a 1,000 cps tone.

TEST

Table 3 furnishes the variation in the signal to noise ratio for the six word groups measured at reference of 18 db signal to noise ratio for a signal of 70 db on the index word "jib." To obtain the mean signal to noise ratio at 80 and 90 db, add 10 or 20 respectively. The standard deviation is the same for the three loudness levels. The N-1 correction was not used in the calculation of the standard deviations since these are not samples of populations, but rather are the entire populations.

Table 2

ORDER OF PRESENTATION OF EXPERIMENTAL CONDITIONS

Subject	Loudness			Clothing Order[a]
	70db	80db	90db	
1	1	2	3	AB
2	1	3	2	AB
3	2	1	3	AB
4	2	3	1	BA
5	3	1	2	BA
6	3	2	1	BA
7	1	2	3	BA
8	1	3	2	BA
9	2	1	3	BA
10	2	3	1	AB
11	3	1	2	AB
12	3	2	1	AB

[a]Order AB was "no headgear" first. Order BA was the reverse. All three loudness conditions were run before the headgear condition was changed. The same order of loudness conditions was then repeated for that subject with the other headgear condition.

Table 3

RELATIVE LOUDNESS (db re 0.0002 DYNE/CM^2) AND SIGNAL TO NOISE RATIO (S/N) COMPARED TO INDEX WORD "JIB" AT 70 db LOUDNESS

	Word Group						Combined Groups
	1	2	3	4	5	6	
Mean Loudness	63.66	63.82	66.20	66.84	66.60	67.42	65.76
Mean S/N Ratio	11.66	11.82	14.20	14.84	14.60	15.42	13.76
S.D.	2.71	2.74	2.46	2.06	3.05	1.67	2.89

Tables 4, 5, 6, and 7 furnish the number of errors in the combinations of headgear and loudness for each subject tested according to:

1) Number of words (syllables) incorrect.
2) Number of initial consonants incorrect.
3) Number of vowels incorrect.
4) Number of terminal consonants incorrect.

Tables 8 to 11 are analysis of variance summaries for the four measures listed above.

It should be no surprise that one hears significantly better with headgear off than with headgear on. The magnitude of this difference can be seen by comparing the sum of sums for the two headgear conditions within each of Tables 4 to 7. For example, in Table 4 the numbers of errors in the two conditions are 200 and 82. The significance of the difference between these two error rates[1] ($.005<p<.01$) is furnished in the last column of the second row of Table 8.

Two other comparisons are probably of greater interest. Signal loudness is a highly significant factor, exceeding the $p<.001$ level on three of the four measures. This is of no particular concern except when combined with the obtained significant interaction between loudness and the presence or absence of headgear. This interaction reflects the fact that the hearing penalty for wearing cold weather headgear is disproportionately greater for low signal to noise ratios. This is illustrated in Figure 1. Thus, the soldier listening for signs of surreptitious enemy movement is more penalized by the headgear than the soldier listening for orders.

Table 4

NUMBER OF WORDS INCORRECT

	Headgear On			Headgear Off		
Subject	70db	80db	90db	70db	80db	90db
1	19	6	4	7	1	1
2	15	2	0	8	0	1
3	8	2	1	11	2	0
4	5	3	3	2	0	0
5	14	3	3	1	1	3
6	12	2	0	2	2	1
7	14	5	0	3	1	0
8	7	3	4	5	0	1
9	25	2	1	4	1	0
10	8	1	1	11	2	1
11	5	0	2	3	0	0
12	16	3	1	4	1	2
	148	32	20	61	11	10
		Sum=200			Sum=82	

[1] A difference significance at the .01 level theoretically would have occurred by chance alone only one time in 100 observations. Generally, a difference significant at the .05 level (theoretically occurs five times in 100 observations by chance alone) is regarded as sufficiently unlikely to have occurred by chance to permit a conclusion that a true difference exists.

NUMBER WORDS INCORRECT AS A FUNCTION OF LOUDNESS FOR THE HEADGEAR ON AND THE HEADGEAR OFF CONDITIONS

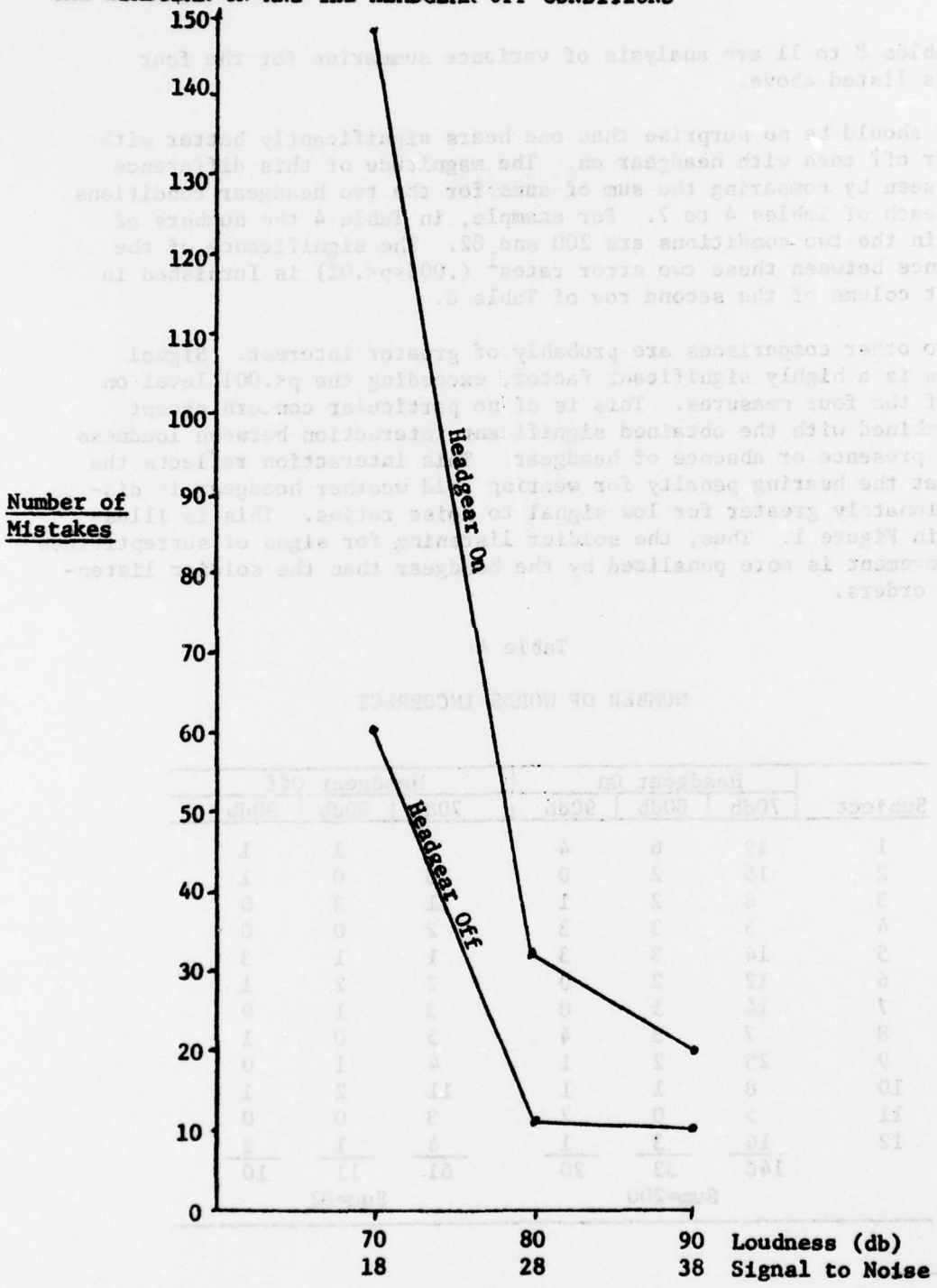

Figure 1

Table 5

NUMBER OF INITIAL CONSONANTS INCORRECT

Subject	Headgear On			Headgear Off		
	70db	80db	90db	70db	80db	90db
1	15	4	3	3	1	1
2	12	1	0	3	0	1
3	3	0	1	9	1	0
4	3	3	2	0	0	0
5	9	1	1	1	1	0
6	8	1	0	1	0	1
7	10	4	0	3	0	0
8	4	2	1	2	0	1
9	17	0	1	1	0	0
10	4	1	0	7	0	0
11	4	0	0	3	0	0
12	11	0	0	3	1	0
	100	17	9	36	4	4
	Sum=126			Sum=44		

Table 6

NUMBER OF VOWELS INCORRECT

Subject	Headgear On			Headgear Off		
	70db	80db	90db	70db	80db	90db
1	1	1	1	3	0	0
2	6	0	0	1	0	0
3	3	1	0	1	0	0
4	0	1	0	1	0	0
5	1	0	0	0	0	1
6	0	0	0	0	2	0
7	5	0	0	0	1	0
8	0	0	1	0	0	0
9	5	0	1	0	0	0
10	1	0	1	1	1	0
11	1	0	2	0	0	0
12	1	3	0	0	0	1
	24	6	6	7	4	2
	Sum=36			Sum=13		

Table 7

NUMBER OF TERMINAL CONSONANTS INCORRECT

Subject	Headgear On			Headgear Off		
	70db	80db	90db	70db	80db	90db
1	7	1	1	5	0	0
2	11	2	0	4	0	0
3	4	1	0	4	1	0
4	2	2	1	1	0	0
5	8	2	2	0	0	2
6	6	1	0	1	0	0
7	7	1	0	0	0	0
8	3	1	2	3	0	1
9	17	0	1	3	1	0
10	4	0	0	4	1	1
11	1	0	0	0	0	0
12	5	0	1	2	0	1
	75	11	8	27	3	5
	Sum=94			Sum=35		

Table 8

ANALYSIS OF VARIANCE SUMMARY[1]

Number of Mistakes: Words

Source	SS	df	MS	F	p
(A) Loudness	830.0833	2	415.0416*	33.62	p<.001
(B) Headgear	193.3888	1	193.3888**	9.95	.005<p<.01
(S) Subjects	13.0000	11	1.1818		
AB	145.0279	2	72.5140***	15.37	p<.001
AS	272.4167	22	12.3826*		
BS	213.7778	11	19.4343**		
ABS	103.8055	22	4.7184***		

[1]Like numbers of asterisks beside pairs of mean squares means that pair constituted an F ratio.

Table 9

ANALYSIS OF VARIANCE SUMMARY

Number of Mistakes: Initial Consonants

Source	SS	df	MS	F	p
(A) Loudness	394.6945	2	197.3472*	95.36	p<.001
(B) Headgear	93.3889	1	93.3887**	11.87	.005<p<.01
(S) Subjects	54.6112	11	4.9647		
AB	85.3611	2	42.6806***	5.09	.01<p<.025
AS	45.5278	22	2.0694*		
BS	86.6111	11	7.8737**		
ABS	184.4166	22	8.3826***		

Table 10

ANALYSIS OF VARIANCE SUMMARY

Number of Mistakes: Vowels

Source	SS	df	MS	F	p
(A) Loudness	13.5278	2	6.7639*	5.38	.01<p<.025
(B) Headgear	7.3472	1	7.3472**	7.47	.01<p<.025
(S) Subjects	7.4861	11	0.6805		
AB	5.5278	2	2.7639***	1.72	NS
AS	27.6389	22	1.2563*		
BS	10.8195	11	0.9836**		
ABS	35.3055	22	1.6048***		

Table 11

ANALYSIS OF VARIANCE SUMMARY

Number of Mistakes: Terminal Consonants

Source	SS	df	MS	F	p
(A) Loudness	217.5833	2	108.7916*	23.64	p<.001
(B) Headgear	48.3472	1	48.3472**	13.47	.001<p<.005
(S) Subjects	54.0417	11	4.9128		
AB	50.6945	2	25.3473***	7.69	.001<p<.005
AS	101.2500	22	4.6023*		
BS	39.4861	11	3.5896**		
ABS	72.4722	22	3.2942***		

Table 4 deals with the number of monosyllabic words incorrectly reported. Tables 5, 6, and 7 deal with the nature of the mistakes. An examination of these last three tables reveals that most of the mistakes were with the consonants. Roughly only one-third as many mistakes involved vowels as involved the initial consonant, with about the same situation for the terminal consonant.

Furthermore, the interaction between loudness and headgear is significant for both the initial and terminal consonants, but not significant for the vowels. Thus, the disproportionately greater hearing penalty for wearing the headgear with low signal to noise ratios is due primarily to mistakes with consonants. This is probably due both to the qualitative differences between vowel and consonant sounds and to the comparative brevity of consonant sounds. However, more vowel errors are also committed at low S/N ratios.

APPENDICES

Appendix A: Score Sheets

Date: _____

Beginning Time: _____

Subject Name: _____

Number: _____

GROUP 1.

Loudness: 70 ☐ 80 ☐ 90 ☐

Headgear: On ☐ Off ☐

ACTUAL	db	REPORTED	INCORRECT			
			SYLLABLE	VOWEL	1ST CONS.	2D CONS.
1. jib	70					
2. wel (well)	67					
3. red (reed)	66					
4. man	65					
5. kid	68					
6. pep	67					
7. suk (suck)	65					
8. por (pour)	66					
9. rer (rear)	67					
10. zap	64					
11. hep (heap)	61					
12. dor (door)	65					
13. sok (soak)	65					
14. dam	62					
15. nok (knock)	60					
16. sip	64					
17. nub (knubb)	61					
18. sod	61					
19. hid	69					
20. gal	63					
21. kar (car)	62					
22. rub	66					
23. vim	67					

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GROUP 1.

ACTUAL	db	REPORTED	INCORRECT			
			SYLLABLE	VOWEL	1ST CONS.	2D CONS.
24. jot	62					
25. jen (Jean)	63					
26. ten (10)	61					
27. kus	61					
28. wig	67					
29. lom (loam)	64					
30. lul (lull)	67					
31. fin	66					
32. ler (leer)	65					
33. fob	62					
34. sag	61					
35. yam	61					
36. rid	61					
37. pig	63					
38. gun	60					
39. mok (mock)	59					
40. tak (tack)	59					
41. bul (bull)	66					
42. men	63					
43. hak (hack)	60					
44. nip	65					
45. gob	61					
46. cem (seam)	64					
47. can	63					
48. bud	64					
49. dug	64					
50. mut	60					

Date: _____

Beginning Time: _____

Subject Name: _____

Number: _____

GROUP 2.

Loudness: 70 ☐ 80 ☐ 90 ☐

Headgear: On ☐ Off ☐

ACTUAL	db	REPORTED	INCORRECT			
			SYLLABLE	VOWEL	1ST CONS.	2D CONS.
1. for	70					
2. hum	65					
3. kuf (cuff)	64					
4. rer (rear)	68					
5. rex	66					
6. lak (lack)	63					
7. rob	66					
8. der (dear)	68					
9. dad	65					
10. cen (seen)	64					
11. nob (knob)	61					
12. hip	62					
13. nab	62					
14. sad	61					
15. nol (knoll)	66					
16. sek (seek)	61					
17. lum	63					
18. but	61					
19. hom (home)	65					
20. fib	65					
21. kit	62					
22. fat	60					
23. kad	65					

GROUP 2.

ACTUAL	db	REPORTED	INCORRECT			
			SYLLABLE	VOWEL	1ST CONS.	2D CONS.
24. ram	64					
25. lep (leep)	61					
26. vat	60					
27. fun	62					
28. gor (gore)	65					
29. son	62					
30. sup	60					
31. cin (sin)	64					
32. gas	63					
33. hit	60					
34. dil	68					
35. yor (yore)	69					
36. gem (Jim)	64					
37. rug	61					
38. kon (cone)	63					
39. cul (cull)	63					
40. ruf (rough)	71					
41. yen	65					
42. tab	62					
43. lit	65					
44. pin	63					
45. ded (dead)	67					
46. lug	63					
47. vin (vine)	61					
48. cot	60					
49. nek (neck)	64					
50. jib	68					

Date: _____

Beginning Time: _____

Subject Name: _____

Number: _____

GROUP 3.

Loudness: 70 ☐ 80 ☐ 90 ☐

Headgear: On ☐ Off ☐

ACTUAL	db	REPORTED	INCORRECT			
			SYLLABLE	VOWEL	1ST CONS.	2D CONS.
1. hen	65					
2. jab	68					
3. yeg (yegg)	71					
4. sap	66					
5. ren (rain)	65					
6. nit (knit)	66					
7. kil	69					
8. lip	70					
9. hot	62					
10. tug	66					
11. dem (deem)	68					
12. bor (boar)	71					
13. rok (rock)	63					
14. kog	62					
15. ber (bear)	72					
16. win	68					
17. kat	64					
18. ton	65					
19. pub	66					
20. kur (cure)	67					
21. nut	63					
22. rat	65					
23. gam	66					

GROUP 3.

ACTUAL	db	REPORTED	INCORRECT			
			SYLLABLE	VOWEL	1ST CONS.	2D CONS.
24. mif (miff)	65					
25. mud	69					
26. sit	67					
27. tem (team)	66					
28. hut	62					
29. vip	68					
30. ken (keen)	66					
31. cud	66					
32. nag	66					
33. pok (pock)	62					
34. jun (June)	65					
35. buk (book)	66					
36. mis (miss)	67					
37. was	68					
38. pen	64					
39. rug	68					
40. dan	67					
41. lot	62					
42. nod	65					
43. wet	66					
44. muk (muck)	66					
45. bot (boat)	68					
46. fom (foam)	69					
47. set	65					
48. cap	62					
49. bir (beer)	68					
50. hil (hill)	69					

Date: _____

Beginning Time: _____

Subject Name: _____

Number: _____

GROUP 4.

Loudness: 70 ☐ 80 ☐ 90 ☐

Headgear: On ☐ Off ☐

ACTUAL	db	REPORTED	INCORRECT			
			SYLLABLE	VOWEL	1ST CONS.	2D CONS.
1. fal (fall)	67					
2. won	67					
3. nak (nack)	66					
4. hub	67					
5. ges (guess)	72					
6. bac (back)	68					
7. wad	65					
8. gul (gull)	71					
9. tin	66					
10. den (dean)	68					
11. num (numb)	68					
12. fum (fume)	68					
13. pun	64					
14. fig	67					
15. dip	67					
16. lid	69					
17. ran	67					
18. lap	66					
19. nab	66					
20. yel	68					
21. jac (jack)	68					
22. net	67					
23. bed	69					

GROUP 4.

ACTUAL	db	REPORTED	INCORRECT			
			SYLLABLE	VOWEL	1ST CONS.	2D CONS.
24. cik (sick)	68					
25. rot	64					
26. mid	68					
27. puf (puff)	64					
28. dim	66					
29. sed (seed)	65					
30. cup	65					
31. van	67					
32. hon (hone)	68					
33. tot	65					
34. ful (full)	70					
35. lem (limb)	66					
36. jut (jutt)	67					
37. tuf (tough)	62					
38. per (peer)	68					
39. mon (moan)	68					
40. nik (nick)	64					
41. gir (gear)	70					
42. dok (dock)	61					
43. kom (come)	65					
44. kes (keys)	68					
45. con	65					
46. bib	68					
47. fer (fear)	68					
48. pan	66					
49. bon (bone)	69					
50. lok (lock)	66					

Date: _____

Beginning Time: _____

Subject Name: _____

Number: _____

GROUP 5.

Loudness: 70 ☐ 80 ☐ 90 ☐

Headgear: On ☐ Off ☐

ACTUAL	db	REPORTED	INCORRECT			
			SYLLABLE	VOWEL	1ST CONS.	2D CONS.
1. rim	73					
2. gum	71					
3. zip	70					
4. nun	69					
5. jet	67					
6. lun (loon)	67					
7. wan	66					
8. jug	71					
9. dun	69					
10. zax	67					
11. jad (jade)	72					
12. mug	68					
13. red (red)	70					
14. dul	70					
15. fel (fell)	68					
16. hul (hull)	68					
17. pot	62					
18. nil	66					
19. nat (gnat)	65					
20. lob	65					
21. silk	65					
22. jog	67					
23. gon (gone)	67					

GEOUP 5.

ACTUAL	db	REPORTED	INCORRECT			
			SYLLABLE	VOWEL	1ST CONS.	2D CONS.
24. bak (bake)	72					
25. tel	65					
26. bol (bowl)	71					
27. mob	65					
28. bet	67					
29. fog	68					
30. web	68					
31. put	66					
32. mer (meer)	66					
33. tip	67					
34. dot	66					
35. tog	64					
36. mat	64					
37. tub	66					
38. top	59					
39. pet	61					
40. pat	60					
41. yaw	65					
42. ham	64					
43. pit	62					
44. gin	65					
45. kep (keep)	63					
46. hem	66					
47. wil	68					
48. cam	63					
49. mit	67					
50. bit	69					

Date: _____

Beginning Time: _____

Subject Name: _____

Number: _____

GROUP 6.

Loudness: 70 ☐ 80 ☐ 90 ☐

Headgear: On ☐ Off ☐

ACTUAL	db	REPORTED	INCORRECT			
			SYLLABLE	VOWEL	1ST CONS.	2D CONS.
1. jip (gyp)	70					
2. sub	70					
3. sop	67					
4. bin	69					
5. fan	67					
6. let	67					
7. cil (sill)	70					
8. got	66					
9. get	66					
10. ned (need)	70					
11. pod	65					
12. fuz (fuzz)	66					
13. pil	66					
14. hog	67					
15. mop	65					
16. bun	68					
17. gut	68					
18. rig	70					
19. rod	67					
20. ser (sear)	69					
21. cod	65					
22. tad	66					
23. rek (wreck)	67					

GROUP 6.

ACTUAL	db	REPORTED	INCORRECT			
			SYLLABLE	VOWEL	1ST CONS.	2D CONS.
24. yat (yacht)	67					
25. lim (limb)	67					
26. til (till)	69					
27. ced (seed)	67					
28. fus (fuss)	66					
29. dum (dumb)	68					
30. las (lass)	64					
31. hat	64					
32. nak (knack)	65					
33. com (come)	67					
34. sun	68					
35. job	70					
36. din	67					
37. dud	70					
38. fet (feet)	67					
39. man	67					
40. jeb	69					
41. ter (tier)	70					
42. dol (doll)	67					
43. luk (luck)	66					
44. buk (buck)	67					
45. med (meade)	68					
46. zag	66					
47. pas (pass)	67					
48. gig	70					
49. fit	68					
50. vag (vague)	69					

Appendix B

INSTRUCTIONS

This is a test of the ability to understand spoken English while wearing cold weather headgear. Monosyllabic words will be played over a tape recorder at five-second intervals. After each word is played you will repeat the word into your microphone. We will repeat this procedure for three loudness levels with the cold weather gear on and off. Thus, there will be six groups of words. Each word list is 50 words long. The entire experiment requires about 40 minutes.